SAMPLING THE DEMERSAL FAUNA FROM A COMMERCIAL PENAEID PRAWN FISHERY OFF THE CENTRAL QUEENSLAND COAST

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Two hundred and eighty-one trawl samples (mean weight 35 kg) of benthic fish and invertebrates were gathered from an area of approximately 10,000 square km adjacent to the central Queensland coast, between January 1985 and June 1986. This area is presently subjected to seasonal fishing pressure by commercial prawn trawlers. Samples were taken from 24 fixed stations representing depths from 15 to 62 m, and a variety of bottom types. Of 477 taxa identified, 18 were commercially important. Despite the proximity of coral reefs, the fauna was dissimilar to the 'reef fauna' characteristic of the Great Barrier Reef. The results suggest a strong association between the demersal trawl faunas of north-eastern Australia and the Southeast Asian regions.

□ *Benthic fauna, demersal fauna, trawling, fishing, Great Barrier Reef, coral reef, faunal survey.*

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The prawn trawl fishery off Queensland's eastern central coast, between Lucinda and Bowen (18°30'S to 20°S), is characterised by two seasons, each representing specific areas of exploitation and target species. From March through to June, fishing effort is centred on the inshore coastal fringe in 10 to 30 m depth for tiger prawns (*Penaeus esculentus* and *P. semisulcatus*). Towards the end of this season, however, fishing effort shifts eastwards into deeper waters where king prawns (*P. longistylus* and *P. latisulcatus*) are sufficiently abundant to support fishing through to October (Robertson and Dredge, 1986). Two separate fisheries are thus recognised, the 'tiger prawn' fishery and the 'king prawn' fishery. Several important 'by-catch' species are also caught incidentally to the target species of each fishery. Although many prawn trawl fisheries are characterised by a similar seasonal and spatial transfer of effort, this fishery is unusual in that much of the fishing effort directed at king prawns is expended in the vicinity of coral reefs of the Great Barrier Reef complex.

As the king prawn fishery has developed over the past decade, fishing effort has expanded further eastwards into previously unfished areas and closer to individual reefs. The benthic faunal composition of these areas is poorly documented (Cannon and Goeden, 1982). Consequently, the trawl catch of the fishery is of considerable interest both to benthic community ecologists (see Cannon *et al.*, 1987) and to the managers of the Great Barrier Reef Marine Park. A comprehensive description of the benthic community subjected to trawling activity is essential to the assessment of fishing impact on adjacent coral reefs. The Queensland Department of Primary Industires initiated a survey of the commercially fished area in 1985. This paper provides details of the methods employed and species composition of the fishery. A second paper (Watson and Goeden, M.S.) examines the species diversity and spatial and temporal distribution of species.

METHODS

Monthly samples of trawl catch were gathered from 20 sites representative of both the tiger prawn and king prawn areas of the fishery (Fig. 1), during 1985. From January to June 1986, monthly sampling was continued at seven of these sites and was started at another four. Sampling was intentionally biased towards the king prawn grounds within inter-reef waters where the benthic faunal composition was of greatest interest. This sampling strategy jointly satisfied the requirements of the demersal fauna research program and of parallel Departmental programs concerned specifically with the commerical catch.

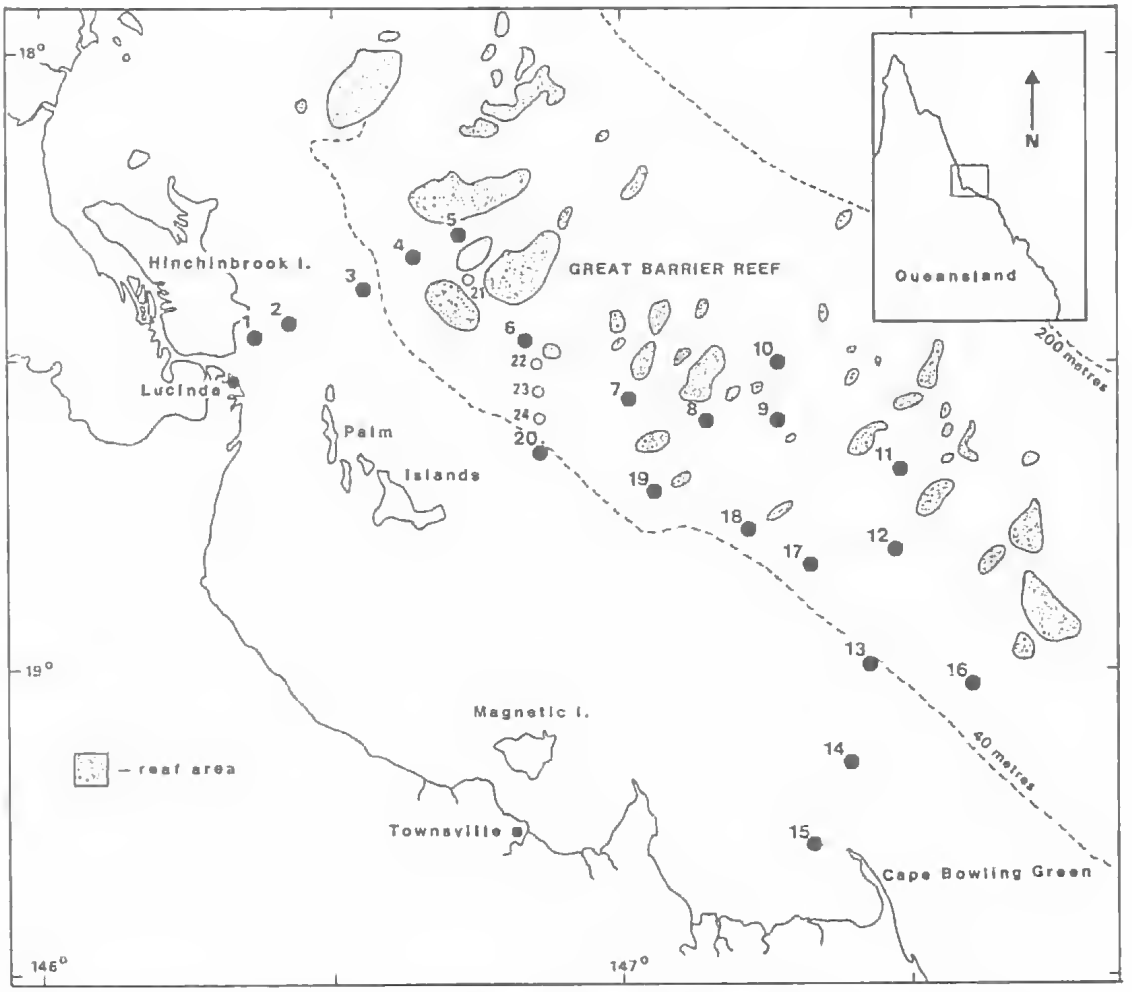

FIG. 1. Sampling stations. Stations 1 to 20 sampled each month from January to December 1985. Stations 1 to 6, 20 and additional stations 21 to 24 were sampled from January to June 1986.

Research officers conducted the sampling from the Fisheries Research Vessel 'Gwendoline May', a 20 m steel trawler, on consecutive nights around the time of new moon. The 'Gwendoline May' was equipped with commercial trawling gear: two 'Florida Flyer' nets, each of 12-metre headline length. The starboard net was made of 50 mm mesh, which is standard for the fishery; the port net was 40 mm mesh, which facilitated the capture of juvenile prawns.

For each sample, the nets were towed at 6 km/hr over the bottom and parallel to the depth contour, for approximately thirty minutes. Upon retrieval, the catch from each net was spilt onto a divided sorting tray. Catch sub-samples were taken from the standard commercial net (starboard), unless gear failure necessitated the use of the port net's catch. The total catch of the starboard net was weighed after sponges, sea snakes, stingrays, shovel-nose sharks and other large elements had been recorded and removed. Each sub-sample (approx. 10 kg) was thoroughly washed in sea-water, weighed, labelled and frozen in a plastic tray. The remaining catch was sorted and species not previously recorded from the survey were retained for positive identification to augment the species list.

All catch sub-samples were sorted at the Northern Fisheries Research Centre in Cairns. Most fish, crustaceans, echinoderms, and molluscs were identified to species level. Other faunal elements were identified to family level or beyond, in most cases. The numerical abundance (number of individuals) of each

species within the sub-sample was also recorded. Extrapolating from the sub-sample, the number of each species in the total catch was then calculated. Biomass and size data for individual taxa were not collected.

While all fish, crustacean and mollusc species have been confirmed by staff of the Queensland Museum, the identifications of the other taxa are provisional only. It was not possible within the scope of this study to specifically identify Porifera, Cnidaria, Sipuncula, Annelida and Bryozoa. For the purposes of comparison with the published results of other faunal surveys, 'demersal fauna' refers to the total trawled catch of fish and macro-invertebrates.

TABLE 1. Commercially important species within the central Queensland prawn trawl fishery. Proportions given were based on the 1985/86 catch. Annual production, particularly for scallops can be highly variable. These percentages are not indicative of the relative monetary value of each species.

Species	Common Name	Estimated proportion of annual commercial catch by weight (%)	Comments
Penaeus longistylus	Red-spot king prawn	32.5	target species of 'king prawn' fishery
P. latisulcatus	Blue-leg king prawn	13.5	target species of 'king prawn' fishery
P. esculentus	Brown tiger prawn	9.0	target species of 'tiger prawn' fishery
P. semisulcatus	Grooved tiger prawn	9.0	target species of 'tiger prawn' fishery
P. merguiensis	Banana prawn	12.0	incidental species of 'tiger prawn' fishery; target species when abundant
P. monodon	Leader prawn	0.5	incidental species of 'tiger prawn' fishery
Metapenaerus endeavouri	Endeavour prawn	1.0	incidental species of 'tiger prawn' fishery
M. ensis	False endeavour prawn	4.0	incidential species of both fisheries
Thenus sp.1	Bay lobster ('sand bug')	10.0	incidential species of 'king prawn' fishery
T. orientalis	Bay lobster ('mud bug')	4.0	incidential species of 'tiger prawn' fishery
Amusium balloti	Saucer scallop	1.5	incidential and target species of the 'king prawn' fishery
Metapenaeopis mogiensis, M. palmensis, M. rosea, Trachypenaeus anchoralis, T. curvirostris, T. granulosus, T. fulvus	Coral prawns	3.0	incidental species of the 'king prawn' fishery Species not separated

RESULTS

A total of 477 taxa were identified from the survey, of which 18 (3.8%) were commercially important (Table 1). Fish and crustaceans were the most abundant components of the catch and accounted for 38% and 42% respectively of the total number of individuals caught (Table 2).

The relative abundance of each species over the entire survey was ranked according to the criteria: rare — less than 100 individuals captured; common — between 100 and 1000 individuals captured; abundant — more than 1000 individuals captured. A systematic list of all taxa is provided in the Appendix. The species ranked abundance and a list of stations at which it was caught is given for each taxa.

The majority of fish gathered were small benthic species of between 10 and 20 cm total length. Flatfish (particularly Bothidae and Paralichthyidae), goatfish (Mullidae), leatherjackets (Monacanthidae), grinners (Synodontidae) and threadfin bream (Nemipteridae) were the most numerous groups (Table 3). Fish species consituted around 75% of the biomass of the catch (Table 2).

Commercially important fish species (particularly Lutjanidae, Lethrinidae and Serranidae) were represented by small juvenile individuals only and they occurred infrequently.

Few of the species collected were considered to be typical coral reef associated fishes (see Russell, 1983). A comparison of the relative number of species in the 10 most speciose reef fish families (Table 4) indicated that the trawled fish fauna was dissimilar to that of the reef.

Crustacean catch was numerically dominated by portunid crabs (30%), small penaeid prawns (61%) (collectively referred to as coral prawns, see Table 1) and the targeted commercial prawns (8%). Despite their numerical abundance and commercial importance, crustaceans represented only 20% of the total biomass of the catch.

Maretia planulata, a small urchin, was the most numerous echinoderm and occasionally dominated a trawl catch. All other echinoderm species and species groups were uncommon. Their number in any one catch rarely exceeded 20 individuals and their contribution to the total catch weight was negligible.

DISCUSSION

The demersal fauna associated with the central Queensland king prawn fishery was characterised by high species diversity and low numerical abundance within individual taxa.

TABLE 2. Abundance and biomass of major taxonomic groups

Group	Abundance of Taxa		Abundance of Individuals %	Biomass %*
	Number	%		
Pisces	272	57	38.3	75
Crustacea	91	19	41.8	20
Echinodermata	50	11	15.8	2
Mollusca	49	10	3.7	1
Other animals	15	3	0.4	2
TOTAL	477	100	100.0	100

* Estimated

TABLE 3. Relative abundance (percent of individuals) of dominant fish groups.

Taxonomic Group	No. of species*	Abundance (%)
FLATFISH (Bothidae, Cynoglossidae, Paralichthyidae, Psettodidae)	11	19.6
GOATFISH (Mullidae)	4	10.6
Paramonacanthus japonicus (Monacanthidae)	1	7.5
LIZARDFISH (Synodontidae)	5	7.2
THREADFISH BREAM (Nemipteridae)	6	7.2
Lepidotrigla calodactyla (Triglidae)	1	3.9
APOGONS (Apogonidae)	5	3.6
Leiognathus splendens (Leiognathidae)	1	3.5
Sorsogonia tuberculata (Platycephalidae)	1	3.5
Hypodytes carinatus (Scorpaenidae)	1	3.0
REMAINING TAXA	237	31.4
TOTAL	272	100.0

* Only includes common species (present in 5% or more of samples).

TABLE 4. Comparison of the proportion (%) of species in ten fish families, representing coral reefs of the Great Barrier Reef and from the trawled fauna adjacent to coral reefs. Fish families selected were the ten most speciose families listed by Russell (1983).

Family	GBR	Trawled fauna
Gobiidae	12.1	0.7
Labridae	8.0	1.9
Pomacentridae	8.0	0.4
Blennidae	4.7	0.7
Apogonidae	3.8	6.3
Serranidae	3.7	3.0
Chaetodontidae	3.7	0.7
Acanthuridae	2.9	0.0
Muraenidae	2.7	0.7
Scaridae	2.6	0.0

Spatial variability in catch composition was pronounced (Watson and Goeden, M.S.). Dominance by an individual species or species group in a catch sample was rare although aggregations of the urchin *M. planulata* were evident from some samples. It is unlikely that their occurrence represented a static '*M. planulata* Community'.

Compared with the demersal trawl fisheries throughout the south-east Asian region (Pauly, 1979), Australia's tropical trawl fisheries are particularly selective in their target species. In Australia, these fisheries are based on large penaeid prawns, and there is only a secondary interest in a few incidental catch components such as bay lobsters (*Thenus* spp.) and squid (Lolliginidae). Despite the economic forces which have led to these differences, the species diversity of the trawled fauna reported from this survey is very similar to that documented for demersal faunas of north-eastern Australia and the south-east Asian region.

Examination of the species composition of the demersal faunas for the Gulf of Carpentaria (see Rainer, 1984, and references therein), the Gulf of Papua (see Watson, 1984, and references therein) and the coastal region of South-east Asia (see Shindo, 1973; Pauly, 1979; and references therein) indicates that the demersal trawl fauna of the central Queensland coast is tropical west Pacific in affinity. Although the ranked dominance order of taxa (at family level) differed between localities, all of the families listed in Table 3 are similarly dominant throughout the tropical west Pacific region. Over 70% of genera and 50% of species are also shared. The demersal trawl fauna represented only a small proportion of species endemic to the Great Barrier Reef region.

Although the central Queensland trawl fishery differs from others of the tropical west Pacific in its proximity to coral reefs, true reef associated species (Russell, 1983) were poorly represented in the fauna described. This indicates that coral reef faunas are largely discrete from those of the adjacent benthic environment which are subjected to commercial trawling.

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APPENDIX

Systematic list of taxa recorded from the central Queensland prawn fishery. Each taxon was classified according to its relative abundance as; rare (R), less than 100 individuals sampled; common (C), between 100 and 1000 individuals sampled; abundant (A), more than 1000 individuals sampled. Stations listed are those at which each taxon was present. Adjacent parentheses indicate species not distinguished during sampling.

Taxa	Abundance and Stations
P. MOLLUSCA	
C. GASTROPODA	
SC. PROSOBRANCHIA	
O. ARCHEOGASTROPODA	
F. FISSURELLIDAE	
Scutus unguis	*R 4*
O. MESOGASTROPODA	
F. XENOPHORIDAE	
Xenophora sp. 1	*C 3-5, 7-14, 16-22*
F. STROMBIDAE	
Strombus dilatatus	*R 18-20, 22*
Strombus vittatus	*R 2*
Terebellum terebellum	*R 19*
F. CYMATIIDAE	
Distorsio reticulata	*R 20*
F. BURSIDAE	
Bursa sp. 1	*R 1*
F. CASSIDAE	
Phalium bisulcatum	*R 1*
Phalium glabratum angasi	*R 17*
F. TONNIDAE	
Tonna cerevisina	*R 18, 20*
Tonna tetracotula	*R 6*
Tonna sp. 1	*R 1*
F. CYPRAEIDAE	
Cypraea sp. 1	*R 14, 20*
F. OVULIDAE	
Volva volva	*R 2, 4, 10*
F. NATACIDAE	
Polinices sp. 1	*R 1*
O. NEOGASTROPODA	
F. MURICIDAE	
Bedeva c.f. paivae	*R 10, 12*
Chicoreus banksii	*R 19*
Chicoreus sp. 1	*R 1, 3, 5, 18*
Murex nigrospinosus	*R 16, 18, 19*
Rapana rapiformis	*R 6*
F. FASCIOLARIIDAE	
Pleuroploca sp. 1	*R 12*
F. HARPIDAE	
Harpa articularis	*R 19*
F. VOLUTIDAE	
Melo sp. 1	*R 3, 7, 14*
Volutoconus grossi mcmichaeli	*R 19*
F. VASIDAE	
Tudicula armigera	*R 19*
SC. OPISTOBRANCHIA	
O. ANASPIDIA	
F. APLYSIIDAE	
Aplysia sp. 1	*R, 12, 22*
Dolabella auriculana	*R 3, 13, 14, 16, 19*
O. NOTASPIDIA	
F. PLEUROBRANCHIDAE	
Pleurobranchidae sp. 1	*C 2, 4, 8, 9, 12-15, 18-22, 24*
O. NUDIBRANCHIA	
F. DORIDIDAE	
Doridae sp. 1	*R 11, 13, 20*
F. CHROMODORIDIDAE	
Ceratosoma cornigerum	*R 4, 14, 15, 17*
F. ARMINIDAE	
Armina sp. 1	*R 2, 15*
C. BIVALVIA	
SC. LAMELLIBRANCHIA	
O. TOXODONTA	
F. ARCIDAE	
Opularca tenella	*R 15*
O. ANISOMYARIA	
F. PECTINIDAE	
Chlamys leopardus	*C 2, 3, 8-13, 16-20, 23*
Chlamys sp. 1	*R 8, 12, 19*
F. AMUSIIDAE	
Amusium balloti	*A 1-24*
Amusium pleuronectes	*A 1-3, 5, 6, 8, 15*
F. SPONDYLIDAE	
Spondylus wrightianus	*R 10*
O. HETERODONTA	
F. CARDIIDAE	
Fragum hemicardium	*R 13*
F. TELLINIDAE	
Tellinidae sp. 1	*R 16, 22*
C. CEPHALOPODA	
SC. COLEOIDEA	
O. SEPIOIDEA	
F. SEPIIDAE	
Metasepia pfefferi	)
Sepia elliptica	*A*)*1-24*
Sepia plangon	)
Sepiadarium kochi	)
F. SEPIOLIDAE	
Euprymna sp. 1	*C 4-8, 10-13, 16-21, 23, 24*

Sepioloidea lineolata R 3, 10, 11, 16

O. TEUTHOIDEA

F. LOLIGINIDAE

Loligo chinensis C 1, 2, 4-8, 10-14, 19, 20, 22, 23

Loligo sp. 1 R 1, 20

Loliolus sp. 1 R 2

O. OCTOPODA

F. OCTOPODIDAE

Octopus spp. C 1-24

P. CRUSTACEA

C. MALACOSTRACA

SC. HOPLOCARIDA

O. STOMATOPODA

F. GONODACTYLIDAE

Gonodactylus graphurus R 5, 8, 15

F. HARPIOSQUILLIDAE

Harpiosquilla harpax R 1, 15, 21

Harpiosquilla melanoura R 19, 21

F. SQUILLIDAE

Squilla anomala C 1, 2, 6, 8, 15

Squilla costata R 1, 15

Squilla multicarinata C 2, 3, 8, 10-14, 16, 18, 19, 22, 23

Squilla nepa R 1

Squilla quinquedentata R 1, 2, 5

Squilla woodmasoni C 1-4, 6, 15, 24

Squilla sp. 1 R 8

Squilla sp. 2 R 1

SC. PERACARDIA

O. ISOPODA

Calcipila cornuta R 4, 16

Creniola saurida R 8

SC. EUCARIDA

O. DECAPODA

F. SOLENOCERIDAE

Solenocera australiana R 1

Solenocera sp. 1 C 1-10, 12, 13, 16, 17, 20-24

Solenocera sp. 2 R 4, 19

F. PENAEIDAE

Atypopenaeus stenodactylus R 1

Metapenaeopsis lamellata A 3-5, 7-14, 16-22, 24

Metapenaeopsis mogiensis A)

Metapenaeopsis palmensis A)1-24

Metapenaeopsis rosea A)

Metapenaeus endeavouri A 1-6, 8, 13-15, 17, 18, 20-24

Metapenaeus ensis A 1, 2, 5, 15

Parapenaeopsis cornuta R 1, 15

Penaeus canaliculatus R 4

Penaeus esculentus C 1, 2, 14, 15

Penaeus latisulcatus A 1-14, 16-21, 24

Penaeus longistylus A 2-14, 16-24

Penaeus merguiensis R 1, 2

Penaeus monodon R 1, 2, 15

Penaeus semisulcatus A 1, 2, 15

Trachypenaeus anchoralis A)

Trachypenaeus curvirostris A)1-24

Trachypenaeus granulosus A)

Trachypenaeus fulvus A)

F. SICYONIDAE

Sicyonia cristata A 3-14, 16-24

F. ALPHIIDAE

Alpheus sp. 1 R 19

F. PALINURIDAE

Panulirus ornatus R 3, 21

F. SCYLLARIDAE

Scyllarus demani C 2-7, 9, 11-14, 16-21, 24

Scyllarus rugosus C 2-10, 12-14, 16-22

Scyllarus martensii R 5, 8, 9, 19, 22

Thenus orientalis A)

Thenus sp. 1 A)1-20, 22, 24

F. PAGURIDAE

Paguridae spp. R 2, 9, 11-13, 16, 17, 19, 20, 24

F. GALATHEIDAE

Galatheidae sp. 1 R 18

F. DROMIIDAE

Dromidia sp. 1 R 14

Dromidiopsis australiensis R 2, 13, 14

Dromidiopsis edwardsi R 20

F. DORIPPIDAE

Dorippe frascone R 3, 20

F. LEUCOSIIDAE

Arcania elongata R 2, 3, 11-13

Ixa inermis R 5-24

F. MAJIDAE

Anstrolobinia capricornensis R 22

Hyastenus campbelli R 3-5, 11, 14, 15

Naxoides taurus R 1

Phalangipus australiensis R 1, 2, 4, 13, 23

F. PARTHENOPIDAE

Cryptopodia sp. 1 R 1, 3, 14

Parthenope contrarius R 15, 16

Parthenope longimanus R 3, 15

Zebrida adamsi R 16, 20

F. CORYSTIDAE

Jonas luteanus R 2, 4, 8-12, 16, 17, 21, 23, 24

Notopus dorsipes R 6, 10

F. PORTUNIDAE

Charybdis anisodon R 1, 2

Charybdis callianassa R 1

Charybdis cruciata R 1, 4, 6, 15

Charybdis jaubertensis A 1-6, 12-14, 16-20, 22, 24
Charybdis natator R 2, 3, 4, 14, 17, 21
Charybdis truncata A 1-6, 8, 9, 15, 20-23
Lupocyclus philippinensis R 3
Lupocyclus rotundatus C 2, 4-14, 16-24
Podophthalmus vigil R 1, 2, 15, 24
Portunus argentatus A 1, 3-12, 15-17, 19, 21-24
Portunus gracilimanus C 1-3, 7, 12, 15
Portunus orbitosinus C 1-6, 8, 10, 11, 15, 16, 19
Portunus pelagicus C 1-5, 7, 14, 15, 17, 21, 24
Portunus rubromarginatus A 1-24
Portunus sanguinolentus R 1, 4, 20
Portunus tenuipes A 2-24
Portunus tuberculosis R 1, 2
Thalamita parvidens R 6
Thalamita sima R 2
Thalamita sp. 1 R 3, 12, 22

F. XANTHIDAE
Actumnus pugilator R 3, 13, 17-19
Demania macnielli R 3, 8, 19
Demania c.f. splendida R 10
Eucrate dorsalis R 1, 8, 15
Liagore rubromaculata R 2
Neoxanthias michelae R 5
Pilumnus ?longicornis R 9
Pilumnus nigrispinifer R 19
Thacanophrys longispinus R 13
Trichia dromiaeformis R 22

P. ECHINODERMATA
C. CRINOIDEA
SC. ARTICULATA
O. COMATULIDA
Comatulid spp. C 1-8, 10, 12-24
F. COMASTERIDAE
Comanthina schlegeli R 21
F. ASTEROMETRIDAE
Pterometra venusta R 11

C. ASTEROIDEA
O. PHANEROZONIA
F. LUIDIIDAE
Luidia maculata R 4, 5, 14-18, 22
F. ASTROPECTINIDAE
Astropecten zebra R 2, 14, 15, 23
F. GONIASTERIDAE
Anthenea sp. 1 R 10, 13, 14, 17, 20
Goniasteridae sp. 1 R 4
Goniodiscaster australiae R 13
Iconaster longimanus R 14
Iconaster sp. 1 R 14
Stellaster equestris C 1-16, 8, 10-20, 24
F. ORIASTERIDAE
Asterodiscus elegans R 12
Culcita novaeguinea R 3
Pentaceraster gracilis R 1, 2, 4, 6, 14, 15, 16
Pentaceraster regulus R 14, 22
Pentaceraster sp. 1 R 15, 19
Poraster superbus R 10, ?13
F. OPHIDIASTERIDAE
Nardoa sp. 1 R 3
Tamaria fusca R 15, 17
Tamaria megaloplax R 19
F. METRODIRIDAE
Metrodira subulata A 3-5, 8, 10, 12, 14, 15, 17, 19-21

O. SPINULOSIDA
F. ACANTHASTERIDAE
Acanthaster brevispinus R 5, 10
Acanthaster planci R 19
F. PTERASTERIDAE
Euretaster insignis R 14

C. OPHIUROIDEA
Ophiuroid spp. R 2-4, 8, 13, 15, 20
O. PHRYNOPHIURIDA
F. EURYALIDAE
Euryale aspera C 4-8, 16, 22-24
O. GNATHOPHIURIDA
F. OPHIOTRICHIDAE
Ophiomaza cacaotica R 5, 8
Ophiothrix martensi australis R 3, 6, 13
O. CHILOPHIURIDA
F. OPHIODERMATIDAE
Ophiarachnella gorgonia R 20
Ophiochasma stellatum R 2, 8, 9, 22

C. ECHINOIDEA
O. CIDAROIDA
F. CIDARIDAE
Prionocidaris bispinosa C 2-5, 7, 9, 10, 12-15, 17, 19-21
O. CENTRECHINOIDA
F. DIADEMATIDAE
Chaetodiadema granulatum C 1, 2, 5, 11, 12, 14-17, 19, 22
F. TEMNOPLEURIDAE
Salmaciella dusumieri A 3-20, 22-24
Temnotrema bothryoides C 2-4, 7, 12-18, 20, 21
Temnotrema sp. 1 R 13, 14, 20
O. EXOCYCLOIDA
F. LAGANIDAE
Peronella lesueuri C 2, 3, 9, 10, 12-15, 17, 18
Peronella orbicularis C 2-10, 12-14, 17-20
F. SPATANGIDAE
Maretia planulata A 2-15, 17-22, 24

C. HOLOTHUROIDEA
O. DENDROCHIROTIDA
F. CUCUMARIIDAE
Pentacta anceps R)
Pentacta crassa R)
Pentacta quadrangularis R)
Psuedoclolochirus axiologus R)
F. PHYLLOPHORIDAE
Actinocucumis typicus R)
Phyllophorus (Urodemella) holothuroides R)
O. ASPIDOCHIROTIDA)
F. HOLOTHURIIDAE)*1-9, 11-22, 24*
Actinopyga echinites R)
Bohadschia sp. 1 R)
Holothuria (Mertensiothuria) sp. 1 R)
Holothuria (Metriatyla) ocellata R)
Holothuria (Metriatyla) martensi R)
F. STICHOPODIDAE R)
Stichopus variegatus R)

P. CHORDATA
C. ASCIDIACEA
Zooanthus sp. 1 *A 2-6, 8-24*
Ascidian spp. *A 2-6, 9-10, 12-24*
C. CHONDRICHTHYES
SC. ELASMOBRANCHI
O. SELACHII
F. ORECTOLOBIDAE
Orectolobus sp. 1 *R 3*
F. HEMISCYLIDAE
Chiloscyllium punctatum *R 1, 9*
O. BATOIDEA
F. RHYNCHOBATIDAE
Rhynchobatus sp. 1 *R 2, 24*
F. DASYATIDAE
Dasyatis kuhlii *R 1-3, 14*
Himantura sp. 1 *R 1*
C. OSTEICHTHYES
SC. ACTINOPTERYGEI
O. CLUPEIFORMES
F. CLUPEIDAE
Amblygaster sirm *R 4*
Sardinella fimbriata *R 1*
F. ENGRAULIDAE
Thryssa hamiltoni *R 1*
Thryssa setirostris *R 1, 2, 14, 15*
Stolephorus devisi *R 1*
O. ANGUILLIFORMES
F. CONGRIDAE
Conger cinereus *R 23*
F. MURAENIDAE
Gymnothorax reticularis *R 6*
Gymnothorax undulatus *R 3*
F. MURAENESCOCIDAE
Muraenesox bagio *R 1*
F. NETTASTOMATIDAE
Nettastomatidae sp. 1 *R 13*
O. SILURIFORMES
F. PLOTOSIDAE
Euristhmus lepturus *R 1*
Euristhmus nudiceps *C 2, 4, 5, 15, 22, 23*
Plotosus anguillaris *R 2, 3, 9, 20*
O. MYCTOPHIFORMES
F. SYNODONTIDAE
Saurida micropectoralis *R 6*
Saurida tumbil *C 1, 2, 5, 15, 23*
Saurida undosquamis *A 1-24*
Saurida sp. 1 (juvenile) *R 1*
Synodus sageneus *A 2-4, 7, 9-14, 16-21, 24*
Synodus similis *A 2-22, 24*
Synodus sp. 1 *R 9*
Trachinocephalus myops *A 2-14,16-21, 23, 24*
O. BATRACHOIDIFORMES
F. BATRACHOIDIDAE
Batrachomoeus trispinosus *C 4, 12, 14, 17-20, 24*
O. LOPHIIFORMES
F. ANTENNARIIDAE
Antennarius commersoni *R 6, 11*
Antennarius hispidus *R 4, 10, 11, 24*
Antennarius mummifer *R 10, 19*
Antennarius striatus *R 3, 6, 9-11, 13, 14, 19, 21,*
Tathicarpus butleri *C 1, 3, 4, 9, 10, 12, 13, 16-20, 23*
F. TETRABRACHIIDAE
Tetrabrachium ocellatus *R 1, 11*
O. OPHIDIIFORMES
F. OPHIDIIDAE
Sirembo jerdoni *R 2, 5, 8, 15, 22*
Sirembo imberbis *R 1*
F. CARAPIDAE
Carapus c.f. homei *R 24*
Jordanicus gracilis *R 5, 19*
O. GADIFORMES
F. BREGMACEROTIDAE
Bregmaceros c.f. nectabanus *R 1, 15*
O. BELONIFORMES
F. BELONIDAE
?Ablennes hians (juv.) *R 24*
F. EXOCOETIDAE
Cypselurus sp. 1 *R 1, 8*

F. HEMIRAMPHIDAE
Euleptoramphus viridis R 10
O. BERYCIFORMES
F. HOLOCENTRIDAE
Sargocentron rubrum R 6, 9, 15, 22
O. SYNGNATHIFORMES
F. SOLENICHTHYIDAE
Solenostomus sp. 1 R 9
F. SYNGNATHIDAE
Halicampus grayi R 3, 14, 19, 20
Hippocampus whitei R 10, 19
Solegnathus lettiensis R 5, 6, 12, 13, 20
F. FISTULARIIDAE
Fistularia commersoni C 1-3, 5, 6, 8-11, 13, 14, 20-24
F. CENTRISCIDAE
Centriscus scutatus A 1-17, 20
O. SCORPAENIFORMES
F. SCORPAENIDAE
Cottapistus cottoides R 3, 13, 20
Dendrochirus brachypterus R 4, 7, 9, 11, 12, 17, 18, 20
Dendrochirus zebra R 3, 10, 17
Erosa erosa C 3-10, 12-14, 16-24
Hypodytes carinatus A 2-24
Inimicus caledonicus A 2-5, 7-24
Liocranium praepositum R 2
Minous trachycephalus C 3-9, 11, 12, 14-16, 19-24
Minous versicolor C 3-6, 8, 9, 12, 14, 15, 24
Paracentropogon longispinus A 2-4, 8, 13-15
Parascorpaena pictus R 15
Peristrominous dolosus C 4, 7, 10, 12, 16-19, 23
Pterois volitans C 2-6, 9, 12, 14-17
Scorpaenopsis cirrhosa R 2, 3, 13, 14
Scorpaenopsis sp. 1 R 14
Tetraroge leucogaster C 3-5, 7-9, 11-13, 16-22, 24
F. TRIGILIDAE
Lepidotrigla calodactyla A 2-24
F. APLOACTINIDAE
Aploactis aspera C 2-4, 6, 9-13, 16-18, 20, 24
Adventor elongatus R 2
Kanekonia c.f. queenslandica R 6, 16
Paraploactis c.f. obbesi R 16, 17, 20
Paraploactis sp. 1 R 3
F. PLATYCEPHALIDAE
Elates ransonneti C 1, 2, 15
Inegocia isacanthus A 1-6, 9, 11, 13-15, 17, 19-21, 24
Onigocia macrolepis R 9, 15
Onigocia spinosus R 2, 17
Onigocia sp. 1 R 3
Onigocia sp. 2 R 9, 18
Papilloculiceps (Cymbacephalus) nematophthalmus R 2, 14
Platycephalus endractensis R 1, 2, 15
Rogadius asper C 2-6, 8, 9, 14, 19-24
Sorsogonia tuberculata A 3-24
Suggrundus macracanthus C 1, 2, 15
Suggrundus sp. 1 C 3-5, 10, 18
Suggrundus sp. 2 C 3-14, 16-24
O. DACTYLOPTERIFORMES
F. DACTYLOPTERIDAE
Dactyloptena orientalis C 1, 3-6, 8, 10, 14-16, 19, 21, 24
Dactyloptena papilio A 1-24
O. PEGASIFORMES
F. PEGASIDAE
Zalises draconis R 4, 8, 18, 20
O. PERCIFORMES
F. SERRANIDAE
Centrogenys vaigiensis R 15
Cephalopholis boenack R 2, 16
Cromileptes altivelis R 24
Epinephalus areolatus R 21, 22
Epinephalus quoyanus R 5
Epinephalus sexfasciatus C 1-3, 5, 15
Epinephalus tauvina R 2
Plectropomus maculatus R 2
F. PSEUDOCHROMIDAE
Pseudochromis quinquedentatus R 1, 4, 24
F. PLESIOPIDAE
Fraudella carasiops R 16, 20
F. TERAPONIDAE
Pelates quadrilineatus C 1, 2, 14, 15, 21
Pelates sexlineatus R 2, 3, 15
Terapon jarbua R 1, 15
Terapon puta R 15
Terapon theraps C 1-4, 14, 15
F. PRIACANTHIDAE
Priacanthus macracanthus C 2-10, 12-20, 22
Priacanthus tayenus C 1-5, 8, 15, 21
F. APOGONIDAE
Apogon aureus R 22
Apogon brevicaudatus R 2
Apogon ellioti A 1-10, 12-24
Apogon c.f. fasciata C 1, 2, 14, 15
Apogon nigripinnis C 1-4, 6, 7, 12, 13, 16-20
Apogon poecilopterus A 1-6, 8-10, 13, 15-20, 24
Apogon quadrifasciatus A 1, 2, 5-11, 13, 15, 17-24

F. POMACANTHIDAE
Chaetodontoplus duboulayi R 15
F. POMACENTRIDAE
Pristotis jerdoni A 2-24
F. CIRRHITIDAE
Cirrhitichthys aprinus R 5
F. CEPOLIDAE
Acanthocepola abbreviato R 2
Aconthocepola krusensterni R 10
F. SPHYRAENIDAE
Sphyroena flovicouda R 12, 15
F. POLYNEMIDAE
Polydactylus heptadactylus R 1, 2, 15
F. LABRIDAE
Choerodon cephalotes C 1-3, 13-15
Choerodon monistigma R 2, 5, 8-10, 15, 22
Choerodon vitta R 5, 8, 15
Choerodon sp. 1 A 3-22, 24
Choerodon sp. 2 R 2, 4, 10, 18, 20
F. OPISTOGNATHIDAE
Opistognathus lautabunda R 1
F. MUGILOIDIDAE
Paropercis diplospilus R 2
Parapercis nebulosa A 2-24
F. URANOSCOPIDAE
Ichthyoscopus fasciatus R 15
Uranoscopus sp. 1 R 5-7, 11, 17
F. BLENNIDAE
Meiloconthus germinatus R 6, 8, 14, 15, 18
Xiphasia setifer R 19, 22
F. CALLIONYMIDAE
Calliurichthys grossi A 1-24
Calliurichthys japonicus R 17
Dactylopus dactylopus A 2-4, 6-9, 11-14, 16-20, 22, 23
Orbonymus rameus A 3-5, 8, 9, 12-21, 24
Repomuscenus belcheri A 1-4, 13, 15, 16
Repomuscenus limiceps R 10
F. GOBIIDAE
Gobiidae sp. 1 R 1
Yongeichthys criniger R 1, 2
F. SIGANIDAE
Siganus fuscescens C 1-4, 13-15, 19-21
F. TRICHIURIDAE
Trichiurus lepturus R 1
O. PLEURONECTIFORMES
F. PSETTODIDAE
Psettodes eurumei C 1-3, 5, 6, 15, 20-24
F. PARALICHTHYIDAE
Pseudorhombus argus C 2, 3, 5-8, 12, 16, 17, 23
Pseudorhombus orsius R 1, 2, 15
Pseudorhombus diplospilus C 1-10, 12, 13, 16-24
Pseudorhombus dupliciocellotus A 2, 4-14, 16-18, 20-24
Pseudorhombus elevatus A 1-3, 5, 7, 10, 15, 23
Pseudorhombus spinosus A 1-24
Pseudorhombus sp. 1 R 5, 20
F. BOTHIDAE
Arnoglossus intermedius A 2-6, 8, 12-24
Arnoglossus waitei A 4-8, 10, 11, 21, 23, 24
Bothus sp. 1 R 10
Engyprosopon grandisquoma A 2-24
Engyprosopon sp. 1 A 3, 5-12, 14, 17, 18, 21
Grammatobothus pennatus C 2-13, 16-24
Grammatobothus polyophthalmus C 1-3, 5-7, 9, 10, 12-15, 21, 23
F. PLEURONECTIDAE
Samaris cristatus C 1, 3-9, 11-14, 16, 18-21, 24
F. SOLEIDAE
Aesopia cornuta R 2, 17, 18, 21
Dexillichthys muelleri R 1, 2, 15
Pardachirus pavoninus R 7, 12
Soleichthys sp. 1 R 2, 12, 14, 17, 18, 20
Strobozebrias cancellotus R 2-4, 13, 14, 20
Zebrias craticula C 3, 4, 7, 9-12, 14, 16-20, 22, 24
F. CYNOGLOSSIDAE
Cynoglossus sp. 1 A 1-21, 23, 24
Cynoglossus sp. 2 R 1, 2, 5
O. TETRAODONTIFORMES
F. TETRAODONTIDAE
Amblyrhynchotes spinosissimus R 10
Anchiosomus multistriatus R 2, 4, 5, 9, 10, 18, 20, 22
Arothron immaculatus R 2
Arothron stellatus R 2, 8, 10, 16, 19
Canthigaster rivuloto R 5, 22
Chelonodon patoca R 15, 17
Lagocephalus scleratus A 1-14, 16-24
Lagocephalus wheeleri R 1
Torquigener brevipinnis R 10
Torquigener parcuspinus R 10

Torquigener tuberculiferus A 1-24
Torquigener whitelyi C 1, 2, 15

F. TRIACANTHIDAE
Triacanthus biaculeatus R 3
Trixiphichthys weberi R 1, 2, 14, 15

F. BALISTIDAE
Abalistes stellaris R 10, 12-14, 19, 23, 24

F. MONACANTHIDAE
Aluterus monoceros R 2
Anacanthus barbatus R 3, 5, 7-9, 12, 15
Brachaluteres taylori R 3, 4, 6, 12, 14, 16, 19-21, 24
Chaetoderma penicilligera R 3-5, 13, 14, 20
Paramonacanthus japonicus A 1-24
Paramonacanthus filicauda R 2
Paramonacanthus sp. 1 R 1, 2, 14, 15
Pseudomonacanthus peroni R 2, 3, 14, 19

F. DIODONTIDAE
Tragulichthys jaculiferus C 2, 3, 9, 13-15, 17, 18, 20

F. OSTRACIIDAE
Lactoria cornuta C 2, 6-8, 10-13, 15-17, 19
Rhyncostracion nasus C 2-5, 9, 11, 13-20, 24
Tetrosomus gibbosus C 8-12, 16, 17, 19-21

C. REPTILIA
SC. LEPIDOSAURIA
O. SQUAMATA
F. HYDROPHIIDAE
Acalyptophis peronii R)
Aipysurus duboisii R)
Aipysurus laevis R)2-12, 14-19,)21-24
Hydrophis ornatus R)
Hydrophiidae spp. R)

P. PORIFERA
several spp. C 2-7, 8, 10, 12-14, 16, 18-22, 24

P. CNIDARIA
Dendronephthia sp. 1 C 1-15, 20, 23
Dendronephthia sp. 2 R 2, 22
Cnidaria spp. R 1, 2, 4, 5, 15, 20, 22

P. SIPUNCULA
several spp. R 4, 12, 17

P. ANNELIDA
Chloea sp. R 4, 6, 12, 23
Annelid spp. R 12, 14, 16, 18-20, 22

P. BRYOZOA
several spp. R 14, 21